DOCUMENT RESUME

ED 080 553 TM 003 058

AUTHOR	Borg, Gunnar; And Others
TITLE	Perceived Difficulty of an Immediate Memory Task.
INSTITUTION	Stockholm Univ. (Sweden). Inst. of Applied Psychology.
SPONS AGENCY	Tri-Centennial Fund, Stockholm (Sweden).
PUB DATE	71
NOTE	12p.; Reports from the Institute of Applied Psychology, University of Stockholm, No. 15, 1971
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Auditory Tests; *Complexity Level; *Memory; *Perception; *Rating Scales; Statistical Analysis; Task Performance; Technical Reports
IDENTIFIERS	Psychophysics

ABSTRACT

Two experiments were performed using messages of digits presented auditorily at a rate of two digits per second. In both experiments, messages of seven different lengths were employed, consisting of 4 to 10 digits in Experiment 1, and of 2 to 8 digits in Experiment 2. The Ss were asked to recall them in the original order, and then to estimate the difficulty of the task by means of the method of magnitude estimation. Messages were presented in pairs of different lengths, the first message in each pair serving as standard for estimating the difficulty of the other message. All pairs were presented twice. In Experiment 1, perceived difficulty was found to be an exponential function of message length. Ss with a higher immediate memory span gave lower estimates for the longest messages than Ss with a lower span. In Experiment 2, the relation between perceived difficulty and message length appeared to be linear. It is argued that with shorter messages, estimates of difficulty were probably affected by the stimulus variable, while with longer messages the response variable (recall) might have been decisive for the perception of difficulty. (Author)

ED 080553

REPORTS FROM THE INSTITUTE OF APPLIED PSYCHOLOGY
THE UNIVERSITY OF STOCKHOLM

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

TM 003 058

GUNNAR BORG
OSWALD BRATFISCH
STANISLAV DORNIČ

PERCEIVED DIFFICULTY OF AN IMMEDIATE MEMORY TASK

PERMISSION TO REPRODUCE THIS COPYRIGHTED MATERIAL HAS BEEN GRANTED BY
G. Borg
TO ERIC AND ORGANIZATIONS OPERATING UNDER AGREEMENTS WITH THE NATIONAL INSTITUTE OF EDUCATION. FURTHER REPRODUCTION OUTSIDE THE ERIC SYSTEM REQUIRES PERMISSION OF THE COPYRIGHT OWNER

FILMED FROM BEST AVAILABLE COPY

No 15, 1971

© 1971 Institute of Applied Psychology,
University of Stockholm,
Råsundavägen 101, 171 37 Solna, Sweden
Director and Editor: Gunnar Borg

PERCEIVED DIFFICULTY OF AN IMMEDIATE MEMORY TASK*

Borg, G., Bratfisch, O., and Dornić, S. Perceived difficulty of an immediate memory task. Reports from the Institute of Applied Psychology, The University of Stockholm, 1971, No. 15.- Two experiments were performed using messages of digits presented auditorily at a rate of two digits per sec. In both experiments, messages of seven different lengths were employed, consisting of 4 to 10 digits in Experiment 1, and of 2 to 8 digits in Experiment 2. The Ss were asked to recall them in the original order, and then to estimate the difficulty of the task by means of the method of magnitude estimation. Messages were presented in pairs of different lengths, the first message in each pair serving as standard for estimating the difficulty of the other message. All pairs were presented twice. In Experiment 1, perceived difficulty was found to be an exponential function of message length. Ss with a higher immediate memory span gave lower estimates for the longest messages than Ss with a lower span. In Experiment 2, the relation between perceived difficulty and message length appeared to be linear. It is argued that with shorter messages, estimates of difficulty were probably affected by the stimulus variable, while with longer messages, the response variable (recall) might have been decisive for the perception of difficulty.

Introduction and problem

A few years ago, the problem of perceived or subjective difficulty of various human activities has attracted the attention of some researchers in psychology. The practical importance of this problem is obvious: perceived difficulty rather than "objective" difficulty of tasks which people have to face in many everyday situations, is very often decisive for their feelings, attitudes, and motivation.

Pilot studies in this area were performed by Borg and Dahlström (1960) and Borg (1962) in the field of physical work. Borg (1961) suggested the idea of using psychophysical methods in the investigation of perceived difficulty. This idea was successfully verified in an experiment on the difficulty of an intelligence test

---

* This investigation was supported by a grant from the Tricentennial Fund of the Bank of Sweden to Prof. Gunnar Borg.

(Borg and Forsling, 1964). A similar topic was studied by Bratfisch and Ekman (1969). Theoretical and methodological problems involved have been recently dealt with in an article by Borg, Bratfisch and Dornić (1970), and a survey of studies carried out so far has been presented (Borg, Bratfisch and Dornić, 1971). A broader research project was then designed the aim of which was to carry out pilot studies of perceived difficulty of motor, perceptual, attention, memory, and problem solving tasks, particularly with regard to some methodological questions.

The first experiment in the planned series of investigations was concerned with perceived difficulty of a motor-skill task as a function of training (Bratfisch, Dornić and Borg, 1970). Repetition of a simple task resulted in a clear-cut drop of perceived difficulty, the relationship between performance time and perceived difficulty being very close: the estimation of difficulty seemed to be based mainly on the perception of time.

Perceived difficulty of a simple memory task was chosen as the subject-matter of the second experimental study within the above project. Memory tasks, particularly those concerning short-term retention, are an important part of everyday life, and perceived difficulty of these tasks undoubtedly influences attitudes and strategies in one's endeavor to cope with problems met in work or study. From the methodological point of view, immediate memory tasks offer a good opportunity to employ for the investigation of the problems under study, even the stimulus variable since it is "unidimensional" (sequences of uniform items) and, hence, can easily be used as a quantitative measure of "objective" difficulty.

Method

Two experiments were performed, each of them using messages of digits presented auditorily at a rate of two digits per second. In Experiment 1, messages of seven different lengths were employed consisting of 4 to 10 digits, respectively. Since the results indicated that it might be of interest to use even shorter messages, Experiment 2 was then designed with messages consisting of 2 to 8 digits. Messages were constructed with regard to the findings concerning the relative easiness of recall (Wickelgren, 1965; Conrad, 1965) so that the only stimulus factor determining performance was the number of items in a message.

The general procedure in both experiments was identical. The S' task was, first of all, to recall each message immediately after presentation, and then to give his estimate of how difficult it was to remember the message. For this purpose, the method of magnitude estimation was used. In Experiment 1, the perceived difficulty of the 7-digit message was denoted as standard and called "10". In Experiment 2, the message consisting of 5 digits served as standard. In both experiments, messages were presented in successive pairs, a comparison stimulus always followed the standard. Having recalled the standard message, S was presented with

another message, which he tried to recall correctly and thereafter to estimate its difficulty in relation to standard. If he felt, for instance, that the comparison stimulus was half as difficult as standard, he should report 5, if he thought it to be twice as difficult, he should report 20, etc. The order of comparison stimuli was randomized and messages of all lengths were presented twice. Ss were instructed to base their judgments entirely on perceived difficulty of remembering the messages, and not on counting or estimating number of digits in messages.

Experiment 1 was first performed on 18 Ss, and the results were shortly described (Borg, Bratfisch, Dornic, 1971). The experiment was then completed using another 6 Ss. Thus, altogether 24 Ss (11 males and 13 females aged 20 to 36) participated in Experiment 1. In Experiment 2, 14 persons (9 males and 5 females, ranging in age from 26 to 39 years) served as subjects.

Results and discussion

Since the perceived difficulty of the memory tasks might have been influenced both by the stimulus variable used and by the response variable (peformance), possible relationship was looked for between estimates of difficulty and message length, as well as between estimates of difficulty and successfulness of recall. The latter concerns, however, only Experiment 1 where the standard (a 7-digit message) was close to the area of immediate memory span.

Experiment 1.

In Fig. 1, the estimates of difficulty (medians of individual means) are plotted against the number of items in the individual messages (Diagram A); in Diagram B, log values are used on the vertical axis. Perceived difficulty seems to be, within the stimulus range employed, an exponential function of the message length.

When trying to interprete the above finding, it must be taken into account that the Ss' estimates might have been contaminated by some basic perceptual qualities of the stimulus variable. The most natural explanation would be that the estimates of difficulty might have been based on the estimation of the number of items within messages. In such a case, however, a different relation could be expected since the number of successively presented auditory stimuli has been repeatedly found to be underestimated (e.g., Taubman, 1944; Cheatham and White, 1954), this tendency typically increasing as a function of actual number (e.g. Taubman, 1950). This is in line with general experience from experiments on immediate memory, showing that Ss tend to underestimate the number of items in longer messages (providing that they do not count the items directly, which is hardly possible when they are concentrated on recall). If, in the present experiment, the Ss had

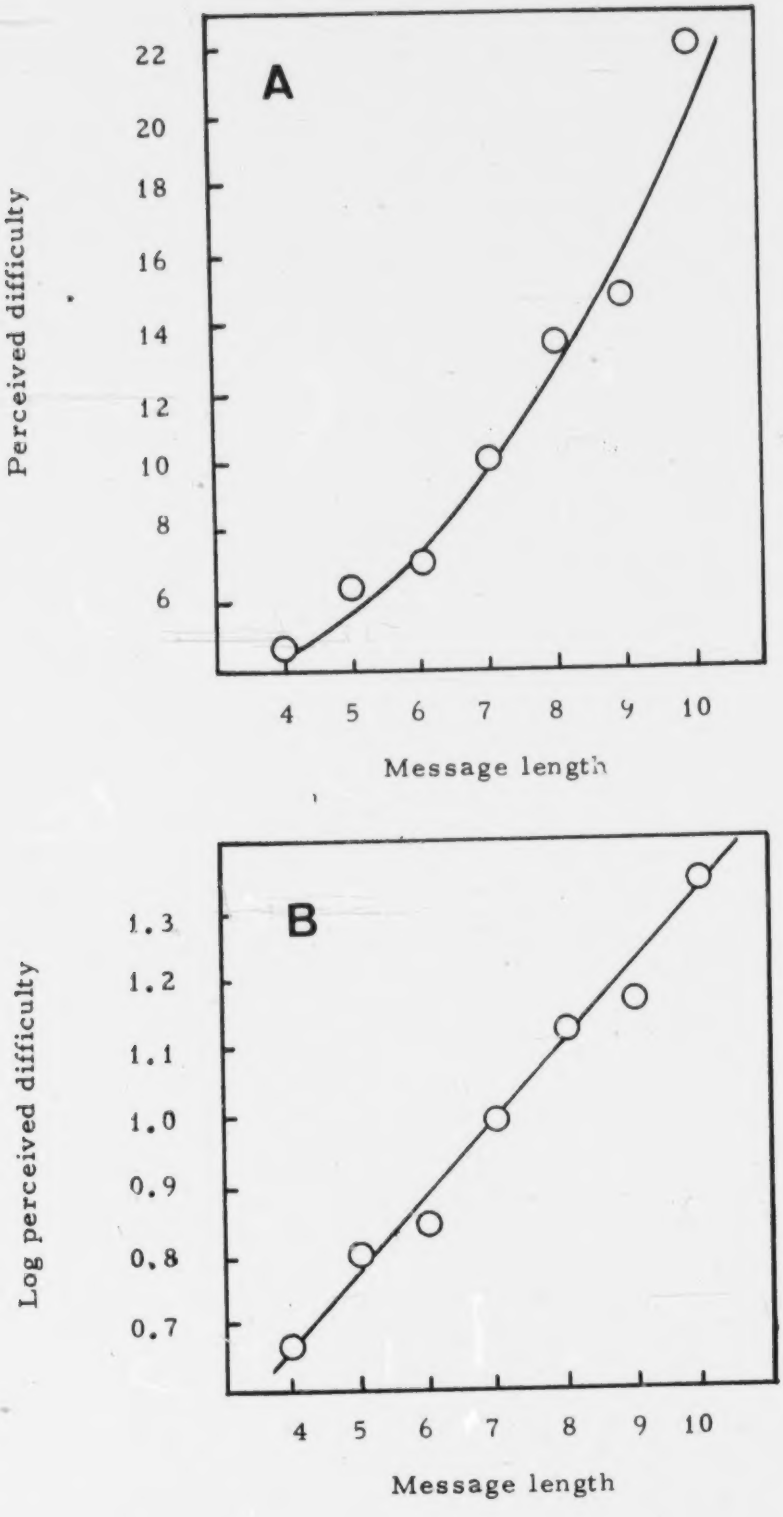

Fig. 1. Perceived difficulty as a function of message length in Diagram A. Log perceived difficulty as a function of message length in Diagram B (Experiment 1).

based their estimates of difficulty on the estimation of number of items, they would not have judged, e.g., 10-digits messages to be more than twice as difficult as 7-digit messages (see Fig. 1).

The situation is, of course, different with the shortest messages where it is possible to perceive the number of items directly, without counting them.

Performance is another factor which might have influenced the estimates of difficulty. Therefore, the relationship was studied between the perceived difficulty of the present task and the successfulness of recall. Since the results of an immediate memory experiment depend, to a high degree, on the methods of scoring (cf. Broadbent and Gregory, 1961; Moray and Barnett, 1965), several different performance criteria were used such as retention of order-information (correct messages), retention of item-information (correct digits regardless of the correct order), omissions, false (inserted) items, repeated items, and blockades. In general, perceived difficulty was found to increase with decreasing performance, but the increase was irregular and differed essentially according to the criteria used.

The Ss were then divided into two groups according to a combined criterion taking into account two main aspects of performance, the retention of order-information and the retention of item-information (cf. e.g. Brown, 1959). Each group consisted of 11 Ss (2 Ss were omitted). The estimates of perceived difficulty (medians of individual means) were then plotted against the message length for the two groups separately (Fig. 2). It can be seen that, with the longest messages, the estimates of the Ss who performed better (empty circles) were distinctly lower. It seems possible that - with the messages above the standard - the estimates were mainly determined by the successfulness of recall. This does not concern shorter messages where practically no mistakes occured.

Experiment 2.

Fig. 3 shows the relation between perceived difficulty and message length in the other experiment using shorter messages. The relationship might be considered as linear. In contradistinction to Experiment 1, the decrease of perceived difficulty from the standard to the shortest message was relatively greater, while the increase of perceived difficulty from the standard to the longest message was relatively smaller.

Since the number of digits in almost all the messages was below the immediate memory span, i.e., there were almost no errors in recall, the response variable apparently could not have the same effect as in Experiment 1. The influence of the stimulus variable was undoubtedly greater in Experiment 2, particularly with the shortest messages, where it was definitely not easy to follow the instruction and to disregard the basic physical properties

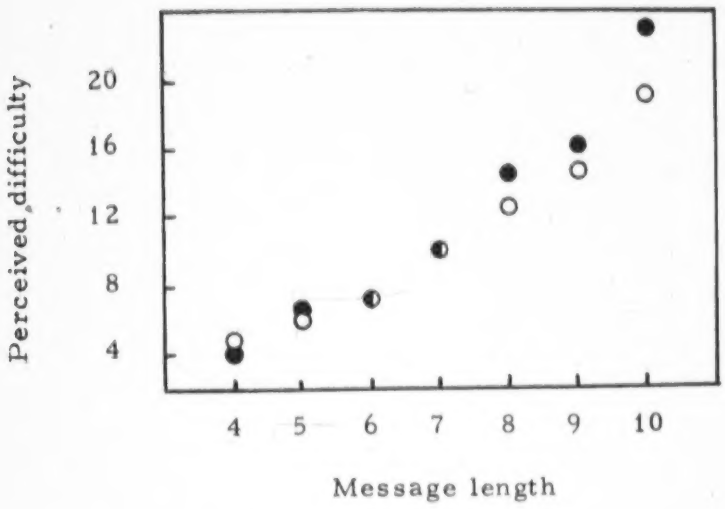

Fig. 2. Perceived difficulty as a function of message length in Experiment 1. Open circles - Ss performing best, filled circles - Ss performing worst.

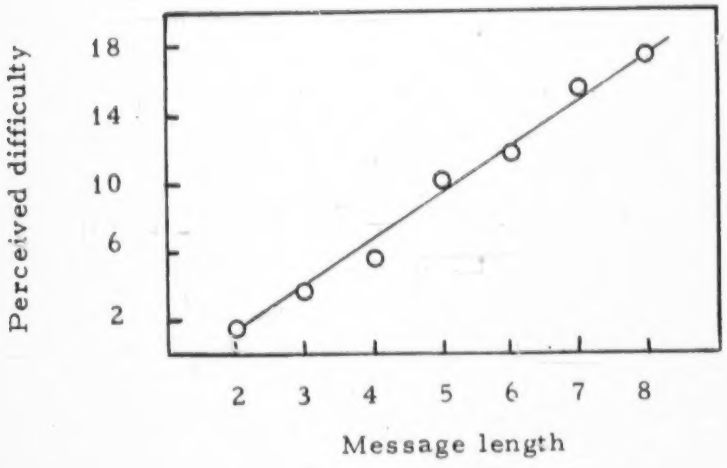

Fig. 3. Perceived difficulty as a function of message length in Experiment 2.

of the stimulus: the task to judge the difference in difficulty between two tasks which were not at all difficult, looked rather artficial. With the longer messages, however, possible influence of subjective performance cannot be disregarded; confidence judgments in experiments on immediate memory indicate that subjective performance might differ from objective performance (cf. Dornič, 1967, 1968).

*

In comparison with an "ordinary" psychophysical experiment, the S's task in some experiments on perceived difficulty is far more complicated since he must "abstract" from the primary perceptual qualities of the stimuli which he is supposed to compare. It is therefore not surprising that perception and estimation of difficulty is often contaminated by secondary factors. Methodological problems connected with the research of perceived difficulty obviously deserve further investigation.

References

Borg, G. Interindividual scaling and perception of muscular force. Kungliga Fysiografiska Sällskapets Lund Förhandlingar, 1961, 12, 117-125.

Borg, G. Physical performance and perceived exertion. Lund, 1962.

Borg, G., Bratfisch, O., and Dornič, S. Perceived difficulty. Reports from the Institute of Applied Psychology, The University of Stockholm, 1970, No. 10.

Borg, G., Bratfisch, O., and Dornič, S. On the problem of perceived difficulty. Scandinavian Journal of Psychology, 1971, (in press).

Borg, G., and Dahlström, H. The perception of muscular work. Publications of the Umeå Research Library, 1960, 5, 1-27.

Borg, G., and Forsling, S. A psychophysical study on perceived difficulty. Educational and Psychological Research Bulletin, Umeå University, 1964, No. 1.

Bratfisch, O., Dornič, S., and Borg, G. Perceived difficulty of a motor-skill task as a function of training. Reports from the Institute of Applied Psychology, The University of Stockholm, 1970, No. 11.

Bratfisch, O., and Ekman, G. Subjective and objective intelligence factors. Psychological Reports, 1969, 25, 607-620.

Broadbent, D.E., and Gregory, M. On the recall of stimuli presented alternately to two sense organs. Quarterly Journal of experimental Psychology, 1961, 13, 103-110.

Brown, J. Information theory. In: B.M. Foss (Ed.), New Horizons in Psychology. Penguin, Harmondsworth, 1966.

Brown, J. Information, redundancy and decay of memory trace. In: Mechanization of Thought Processes. London, 1959.

Cheatham, P.G., and White, C.T. Temporal numerosity: III. Auditory perception of number. Journal of experimental Psychology, 1954, 47, 425-428.

Conrad, R. The role of the nature of the material in verbal learning. Acta Psychologica, 1965, 24, 244-252.

Dornič, S. Expectancy of signals and the memory trace. Studia Psychologica (Bratislava), 1967, 9, 87-92.

Dornič, S. Effect of a specific noise on visual and auditory memory span. Scandinavian Journal of Psychology, 1968, 8, 155-160.

Moray, N., and Barnett, T. Stimulus presentation and methods of scoring in short-term memory experiments. Acta Psychologica, 1965, 24, 253-263.

Taubman, R.E. The effect of practice with and without reinforcement on the judgement of auditory number. Journal of experimental Psychology, 1944, 34, 143-151.

Taubman, R.E. Studies in judged number: I. The judgment of auditory number. Journal of general Psychology, 1950, 43, 167-194.

Wickelgren, W.A. Short term memory for repeated and non-repeated items. Quarterly Journal Psychology, 1965, 17, 14-25.

Abstract card

Borg, G., Bratfisch, O., and Dornič, S. Perceived difficulty of an immediate memory task. Reports from the Institute of Applied Psychology, The University of Stockholm, 1971, No. 15. - Two experiments were performed using messages of digits presented auditorily at a rate of two digits per sec. In both experiments, messages of seven different lengths were employed, consisting of 4 to 10 digits in Experiment 1, and of 2 to 8 digits in Experiment 2. The Ss were asked to recall them in the original order, and then to estimate the difficulty of the task by means of the method of magnitude estimation. Messages were presented in pairs of different length, the first message in each pair serving as standard for estimating the difficulty of the other message. All pairs were presented twice. In Experiment 1, perceived difficulty was found to be an exponential function of message length. Ss with a higher immediate memory span gave lower estimates for the longest messages than Ss with a lower span. In Experiment 2, the relation between perceived difficulty and message length appeared to be linear. It is argued that with shorter messages, estimates of difficulty were probably affected by the stimulus variable, while with longer messages, the response variable (recall) might have been decisive for the perception of difficulty.

Reference card

Borg, G., Bratfisch, O., and Dornič, S. Perceived difficulty of an immediate memory task. Reports from the Institute of Applied Psychology, The University of Stockholm, 1971, No. 15.

REPORTS SO FAR PUBLISHED IN THIS SERIES

No. 1. 1970 Borg, G.: RELATIVE RESPONSE AND STIMULUS SCALES

No. 2. 1970 Bratfisch, O.: TIME-ESTIMATIONS OF THE MAIN ACTIVITIES OF UNIVERSITY STUDENTS

No. 3. 1970 Hosman, J., and Borg, G.: THE MEAN AND STANDARD DEVIATION OF CROSS-MODALITY MATCHES: A STUDY OF INDIVIDUAL SCALING BEHAVIOR

No. 4. 1970 Borg, G., Edström, C.G., and Marklund, G.: A NEW METHOD TO DETERMINE THE EXPONENT FOR PERCEIVED FORCE IN PHYSICAL WORK

No. 5. 1970 Hosman, J.: THE FACTOR STRUCTURE OF MAGNITUDE PRODUCTIONS

No. 6. 1970 Hosman, J.: THE DIMENSIONALITY OF CROSS-MODALITY MATCHES

No. 7. 1970 Borg, G., and Hosman, J.: THE METRIC PROPERTIES OF ADVERBS

No. 8. 1970 Borg, G., Edgren, B., and Marklund, G.: A FLEXIBLE WORK TEST WITH A FEEDBACK SYSTEM GUIDING THE TEST COURSE

No. 9. 1970 Dornič, S., Künnapas, T., and Bratfisch, O.: SUBJECTIVE SIMILARITY AS A FUNCTION OF EXPOSURE TIME AND SHORT-TERM MEMORY

No. 10. 1970 Borg, G., Bratfisch, O., and Dornič, S.: ON PERCEIVED DIFFICULTY

No. 11. 1970 Bratfisch, O., Dornič, S., and Borg, G.: PERCEIVED DIFFICULTY OF A MOTOR-SKILL TASK AS A FUNCTION OF TRAINING

No. 12. 1970 Hosman, J., and Borg, G.: THE METRIC STRUCTURE OF VERBAL EXPRESSIONS: A FURTHER INVESTIGATION

No. 13. 1970 Valter, V.: DEDUCTION AND VERIFICATION OF A QUANTUM PSYCHOPHYSICAL EQUATION

No. 14. 1970 Dornič, S., Bratfisch, O., and Santesson, A.: VERBAL FACTOR IN IMMEDIATE MEMORY